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(54) Front suspension for motor-cycles.

(57) A motor-cycle (1) comprises a frame (2), an engine (3), a handle-bar (47), a front wheel (4) and a rear wheel (5) each of which is provided with a disc (7) and therewith respective pneumatic tyres (6) are associated.

According to the invention, the motor-cycle (1) includes a front suspension system comprising a rigid longitudinal element or arm (10) restrained to a portion (3) of the motor-cycle and laterally arranged of the corresponding wheel (4), said arm (10) bearing, at a free end portion (13) thereof, a guiding body (16) adapted to guide a slider element (17) to which the wheel supporting axle (8) is coupled, said body or guide (16) and said slider element (17) being coupled to one another by a shock absorber element (18) adapted to absorb the shocks and stresses affecting the front wheel (4).

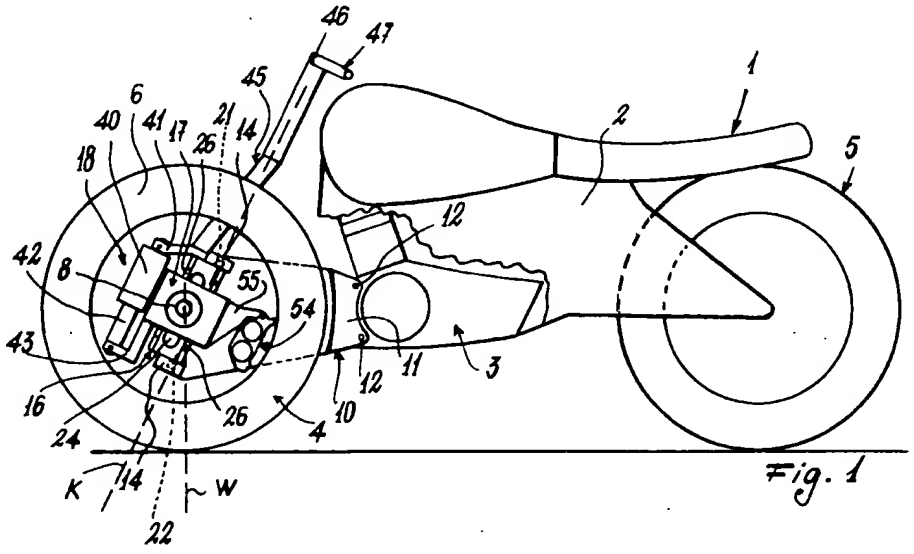

Fig. 1

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The present invention relates to a front suspension for motor-cycles.

Several suspension systems of the above mentioned type are already known, which, while operating in a comparatively satisfactory manner, are however affected by some drawbacks.

These suspensions, for example, have a comparatively large size which weighs down the motor cycles also from a mere aerodynamic standpoint. Accordingly, the motor-cycle has a high fuel consumption and the power of its engine is exploited with a poor efficiency.

Moreover, prior suspension systems (for example a conventional fork suspension system) have frequently a small stiffness which involves obvious problems.

Other suspension systems are very complex construction-wise and have a comparatively high cost.

Accordingly, the main object of the present invention is to provide a front suspension for motor-cycles which has a small size, is reliable in operation, can be made at a low cost and, moreover, has a great mechanical stiffness.

A further object is to provide a suspension of the above mentioned type which has a low weight and which affects only in a negligible way the aerodynamic properties of the vehicle.

According to one aspect of the present invention, the above mentioned objects, as well as yet other objects, which will become more apparent to those skilled in the art, are achieved by a front suspension for motor-cycles of the type comprising a frame, an engine, a handle-bar, a front wheel and a rear wheel, each said wheel being provided with a disc, pneumatic tyres associated with said wheels, said suspension being characterized in that it further comprises a rigid longitudinal arm restrained to a portion of the motor-cycle and laterally arranged of its corresponding wheel, said arm bearing, at a free end portion thereof, a guiding body adapted to operate as a guide for a slider element to which the wheel bearing axle is coupled, said guiding body and slider element being mutually connected through a shock absorber element adapted to absorb the shocks and stresses affecting said front wheel.

The invention will become more apparent thereinafter from the following exemplary disclosure given by way of a merely indicative but not limitative example, with reference to the accompanying drawings, where:

Figure 1 is a partially broken away schematic view showing a motor-cycle according to the invention;

Figure 2 is a front view of the motor-cycle of Figure 1, with some portions being omitted for clearness;

Figure 3 is a top view of the motor-cycle shown in Figure 1;

Figure 4 is a cross-sectional view taken along the section line IV-IV of Figure 3;

Figure 5 is a cross-sectional view taken along the section line V-V of Figure 3, with some portions omitted for clearness;

Figures 6 and 7 show cross-sectional views similar to that of Figure 4, but related to other embodiments of the invention;

Figure 8 is a schematic perspective view of a variation of the motor-cycle of Figure 1; and

Figure 9 is a side schematic view of the motor-cycle of Figure 8.

With reference to Figures 1 to 5, a motor-cycle is herein indicated at 1 and comprises a frame 2, an engine 4, a front wheel 4 and a rear wheel 5.

Each wheel is provided with a pneumatic tyre 6 supported by a disc 7; the latter, in the wheel 4, is rigid with and is supported by a wheel supporting axle 8, whilst the rear wheel is supported by a suspension system known per se, and, accordingly, it has not been shown.

According to the invention, to a portion of the motor-cycle (in the embodiment being disclosed to the engine 3) there is couped a rigid arm 10 which is longitudinally arranged with respect to the motor-cycle 1, that is being substantially parallel to the ground T on which the motor-cycle is driven.

The longitudinal arm 10 is laterally arranged of the wheel 4 and is coupled, at one end 11 thereof, to the engine 3 (or to the frame 12) by restraining means of a per se known type (for example bolts 12).

At the other end portion 13 thereof, the arm 10 has a substantially fork-like shape and is provided with two ring elements 14 which, advantageously, have a common axis K which is slanted with respect to the ground T. In particular, the axis K lies in the middle plane of the wheel, the inclination of said axis and the distance thereof from the axis of the wheel W defining the forward stroke of the motor-cycle 1.

Said arm 10 can be made in a single body or integral with a closed section sheel construction in order to have a high stiffness; however it can also be made in a different way, for example of a welded pipe construction encompassed by a casing.

Said longitudinal rigid arm 10 supports, at said end portion 13 thereof, a guiding element 16 adapted to operate as a guide for driving an element 17, which can slide on said guiding element 16, to which the wheel supporting axle 8 is connected.

Finally, said guiding element 16 and slider element 17 are coupled to a shock absorber element 18 adapted to absorb and dampen the stresses affecting the wheel 4.

More specifically (see Figure 4), the guiding element 16 is provided with a body 20 at the opposite end portions of which there are arranged two pins 21 and 22 (shown in Figure 1) which cooperate with the ring element 14 in which conventional bearings 23 are assembled (Figure 3).

The pins 21 and 22 are advantageously arranged at an eccentrical position on the ends of said body 20.

The latter has a poligonal contour and comprises a central elongated throughgoing gole 24, in which the wheel supporting axle 28 can be displaced.

Laterally, on the perimeter of the body 20, there are provided tracks 25 for the displacement of the guiding elements 26, for example of a roller type; on said elements 26, in turn, the slider element 17 (or simply slider 17) being displaceably driven.

Said slider 17 supports the axle 8 through bearings 27.

In order to compensate or adjust the clearance between the slider 17 and guiding element 16, the slider is provided, on a side 17A thereof, with a plug element 30 having a wall 31 facing the guiding element 16 and provided with a shape complementary to the profile of said guiding element 16. For adjusting the above mentioned clearance, between the slider and guiding element 16 there is moreover arranged at least an insert 33 which, advantageously, can be provided with a wedge-like shape on the side thereof opposite to the side on which there are arranged the elements 26, and cooperating with the side of the slider opposite to that where there is arranged the plug 30.

This insert 33 cooperates with at least a wedge-like element or wedge 35 arranged between said insert and the slider 17, said cooperation allowing to take up or adjust the clearance between said slider and the guiding element 16. The insert 33, furthermore, is restrained in its operating position by means of clamping elements such as, for example, screws 32 (only one of which is shown in the Figures) cooperating with said element 17.

As stated, the slider element 17 and guiding element 16 are coupled by a shock absorber element 18 having a per se known construction.

More specifically, in the embodiment being disclosed and illustrated, a conventional cylinder 40 of the shock absorber element 18 is rigid, through an arm 41, with the guiding element 16, whereas the piston 42, which is movable with respect to this cylinder, is rigid, through an arm 43, with the slider 17.

The absorber element 18, anyhow, can be restrained through its cylinder 40 and piston 41 respectively to the slider 17 and guiding element 16.

Finally, in the exemplary embodiment being disclosed, to the mentioned guiding element 16 there is coupled an end portion 44 of a steering column 45, having at the free end portion 46 thereof, a conventional handle bar 47. This steering column 45 can be restrained, in any known manner, to a single end portion of the body 20 of the guiding element 16, or to both the end opposite portions of said body (as shown by the dashed lines in Figures 2 and 5).

The thus constructed steering column is not associated to any elements of the frame 2 of the motor-cycle, but it is directly supported, through the guiding element 16, by the rigid arm 10.

As shown, at least a conventional brake disc 53 (either of a normal or self ventilated type) is associated in a known manner to the disc 7; on this disc a conventional braking shoe 54 can operate, said shoe being associated to the slider 17 by means of a supporting arm 55.

Supposing now that a motor-cyclist is driving the motor-cycle 1 and desire to change the driving direction.

In this case, by turning the handle bar 47 and accordingly the steering column 45, the guiding element 16 is turned about the pins 21 and 22; the latter, in particular, will turn in the bearings 23 associated with the ring element 14 of the fork end portion 13 of the arm 14.

Since this arm is spaced, by a portion 10A thereof, from the longitudinal axis X of the motor-cycle (Figure 3) the handle bar 47, and accordingly the wheel 4, can be turned in the two directions in an easy manner.

Suppose now that the motor-cyclist desires to brake the motor-cycle.

In this case, the brake shoe 54 will operate on the disc 53 turning with the wheel 4.

Upon braking, a main portion of the motor-cycle weight will be born by the front wheel. Owing to this, and by means of the shoe 54, the slider 17 will slide on the roller guiding elements 26 which, in turn, will be driven on the guide 16 with a speed which, with respect to the latter, is substantially equal to a half of the sliding speed of the slider 17.

This displacement is hindered by the element 18. In fact, under the above mentioned condition, the piston 42 will be driven, together with the slider 17, with respect to the cylinder 40 connected, with the guide 16, to the arm 10.

The element 18, accordingly, will absorb the stresses on the wheel 4.

Likewise, the element 18 will absorb any stresses acting on the wheel 4 during the driving on the ground T, as the ground is uneven. In that case, moreover, the displacements of the wheel 4 due to the suspension movement are allowed by the hole 24 therethrough the axle 8 is driven.

It should be moreover pointed out that even if

the steering column 45, made as stated (direct steering), is not restrained to any sleeve or other restraining means for restraining it to the frame 2, it is so designed as not to be appreciably bent as the motor-cycle is used (and in particular during a braking operation); moreover, both the steering column 45 and the arm 13 are not subjected to torque stresses susceptible to negatively affect their stability and mechanical strength.

Figures 6 and 7 illustrate two modified embodiments of the invention, in said Figures parts corresponding to those of Figures 1 to 5 being indicated at the same reference numbers.

More specifically, in Figure 6 the wheel supporting axle 8 does not pass through the guide 16 but is associated with a single side 80 of the sleeder 17.

In Figure 7, on the other hand, the axle 8 is similar to that of Figure 6 but, in addition to the previous disclosure, the braking disc 53 is arranged on the side of the wheel disc 7 opposite to that where are arranged the guide 16 and slider 17.

In this case, the brake shoe 54 is arranged on the hub bearing axle 8 restrained to the slider 17. Between the axle and disc 7 there is provided at least a conventional bearing 79.

According to this embodiment, the shoe 54 can not turn and is adapted to suitably affect the brake disc 53 to properly brake the vehicle.

Both the embodiment of Figure 6 and that of Figure 7 can be operated in a similar way to that of the already disclosed Figures 1 to 5; thus, such an operation will be not disclosed again.

It should be noted that, advantageously, in all of the shown embodiments, the shock absorber element 18 is symmetrically arranged of the brake shoe 54 with respect to the axle 8. This is provided in order to improve the weight distribution on said axle (and accordingly on the wheel).

Figures 8 and 9 show a variation of the motor-cycle of Figures 1 to 7. In these Figures parts which correspond to the above disclosed parts have been indicated by the same reference numbers.

In the modified embodiment being disclosed, the steering column 45 is of a per se known type and is engaged within a sleeve 88 of the frame 2, the displacement of the handle-bar 47 being transmitted to the front wheel 4 in an indirect way (indirect steering) through rods 89 and 90 and a rocker assembly 91 arranged between the two rods and turning about a fixed pivot pin 92 restrained on the frame 2. As shown, the rods 89 and 90 are arranged in planes which are substantially parallel to the travel direction and on two opposite sides of the motor-cycle 1; the rocker assembly 91 being transversely arranged with respect to the travel direction.

More specifically, the rod 89 is pivoted, through conventional ball couplings 93 and 94 arranged at its opposite end portions, respectively on an arm 95 rigid with the rod 45 and on an end portion of the rocker assembly 91, the arm 95 being substantially parallel to the rocker assembly 91.

The other end of the rocker assembly is pivoted, for example through a ball coupling 98, to the rod 90 which, through a hinge, for example comprising a ball coupling 99, affects a rod 100 rigid with the guide 16.

Thus, as the handle-bar 47 is turned, the wheel 4 is caused to turn in the desired direction by properly driving the rods 89 and 90 and rocker assembly 91 (the movements of which have been indicated by arrows M, N, T). In this case, the transmission ratio of the handle-bar 47 to the wheel 4 can be made variable (by any known means) depending on the steering angle and the dynamic parameters such as speed, braking action, roll angle and the like.

To the foregoing it is to be added that the sleeve 88 can be restrained in addition to the frame 2, or instead to the frame, also to the engine 3 and/or to the longitudinal arm 10.

Finally, the wheel disc 7, in the embodiments shown in the Figures (with the exception of Figure 7) has a high camber in order to substantially hold therewithin the assembly including the guide 16 and slider 17.

Claims

1. A front suspension for motor-cycles of the type comprising a frame, an engine, a handle-bar, a front wheel and a rear wheel, each said wheel being provided with a disc, pneumatic tyres associated with said wheels, said suspension being characterized in that it further comprises a rigid longitudinal arm (10) restrained to a portion (3) of the motor-cycle (1) and laterally arranged of its corresponding wheel (4), said arm (10) bearing, at a free end portion (13) thereof, a guiding body (16) adapted to operate as a guide for a slider element (17) to which the wheel bearing axle (8) is coupled, said guiding body (16) and slider element (17) being mutually connected through a shock absorber element (18) adapted to absorb the shocks and stresses affecting said front wheel (4).

2. A suspension according to Claim 1, characterized in that said rigid longitudinal arm (10) is restrained to the engine (3) of the motor-cycle (1) by any known means.

3. A suspension according to Claim 1, characterized in that said longitudinal rigid arm (10) is restrained to the frame (2) of said motor-cycle (1) by any known means.

4. A suspension according to Claim 1, characterized in that said rigid arm (10) has a free end portion (13) of substantially fork shape and being provided with two ring like elements (14) adapted to rotatively support a body (20) of the guide (16) thereon the slider element (17) is driven.

5. A suspension according to Claim 4, characterized in that said guide (16) is supported by pins (21, 22) which are eccentrically arranged on the body (20) of said guide (16).

6. A suspension according to Claim 4, characterized in that said guide (16) is arranged with the axis (K) thereof slanted with respect to the axis (W) of the wheel (4).

7. A suspension according to Claim 4, characterized in that the body (20) of the guide is provided with a throughgoing elongated hole (24), therethrough the wheel bearing axle (8) can move as the motor-cycle (1) is used.

8. A suspension according to Claims 1 and 4, characterized in that between the guide (16) and smider element (17) there are arranged sliding elements (26), advantageously of a roller cage type, thereon said slider element (17) can slide, said sliding elements (26) being advantageously adapted for movement along sliding tracks (25) formed at least within said guide (16).

9. A suspension according to Claims 4 and 8, characterized in that said suspension comprises means (30, 33) adapted to compensate the clearance between the guide (16) and slider element (17) said means cooperating with said sliding elements (26).

10. A suspension according to Claim 9, characterized in that said means for compensating said clearance comprises at least a wedge element (33) arranged between the guide (16) and slider element (17), said wedge element (33) being adapted to be locked in a set position by conventional screw clamping means (32) cooperating with said slider element (17).

11. A suspension according to Claim 9, characterized in that said means for compensating said clearance comprise a removable element (30) arranged on a side (17A) of said slider element (17), said removable element cooperating with said sliding elements (26) arranged at said guide (16).

12. A suspension according to Claim 1, characterized in that said longitudinal rigid arm (10) has a portion (10A) thereof spaced from the longitudinal axis (X) of said motor-cycle.

13. A suspension according to Claim 1, characterized in that the shock absorber element (18) comprises a cylinder (40) rigid with said guide (16) and a piston (42) which can be mutually displaced in said cylinder (40) and being rigid with said slider element (17).

14. A suspension according to Claim 1, characterized in that said slider element supports at least a conventional braking element (54) adapted to cooperate with at least a conventional brake disc (53) associated with said wheel (4).

15. A suspension according to Claims 13 and 14, characterized in that said shock absorber element (18) is symmetrically arranged of said braking element with respect to said guide (16) rigid with the longitudinal rigid arm (10).

16. A suspension according to Claim 1, characterized in that said suspension comprises a steering column (45) for directly transmitting the rotary movement of said handle-bar (47) to said front wheel (4), said column (45) being rigid with said guide (16) and being independent from said frame (2).

17. A suspension according to Claim 16, characterized in that said steering column (45) is restrained, by any known means, to at least an end portion of said guide (16).

18. A suspension according to Claim 1, characterized in that said steering column (45) is associated with a supporting element (88) restrained to at least one of said frame (2), said longitudinal arm (10) and said engine (3), said steering column (45) indirectly operating said wheel (4) in order to cause said wheel to turn.

19. A suspension according to Claim 18, characterized in that to said steering column (45) there is operatively coupled a rod (89) affecting a rocker assembly (91) coupled to a further rod (90) in turn connected to said guide (16) supported by said longitudinal rigid arm (10), the mutual connection of said rods (89, 90),

rocker assembly (91), steering column (45) and guide (16) being obtained by hinges which are advantageously defined by ball couplings (93, 94, 98, 99), said rocker assembly (91) being pivoted on a pivot pin (92) rigid with the frame (2) of the motor-cycle (1).

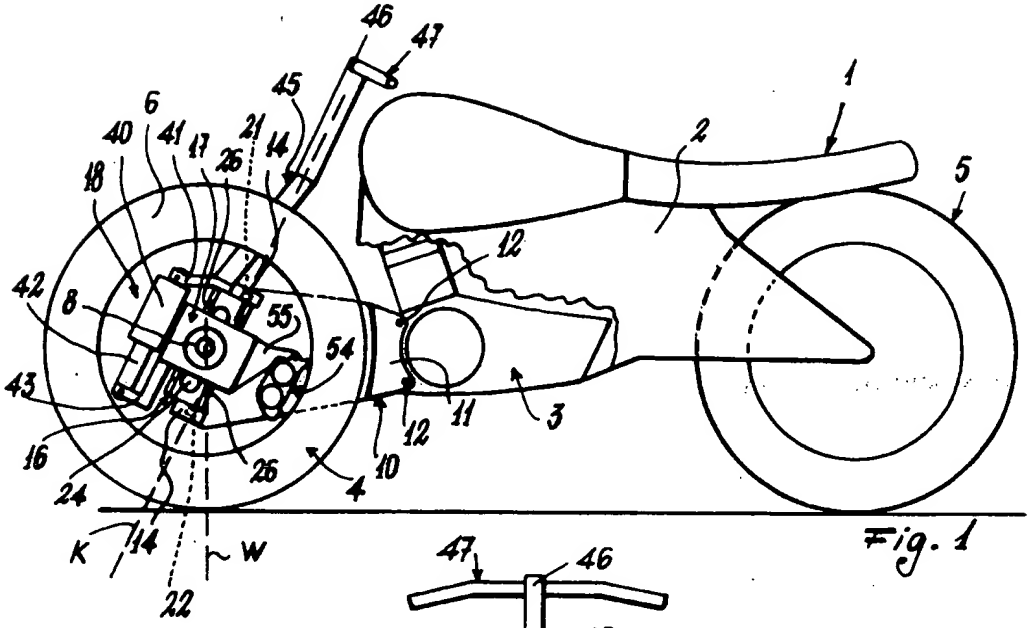

Fig. 1

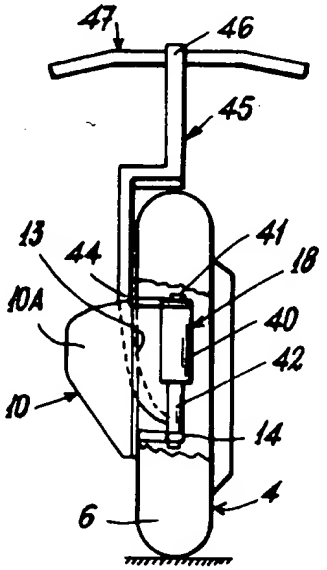

Fig. 2

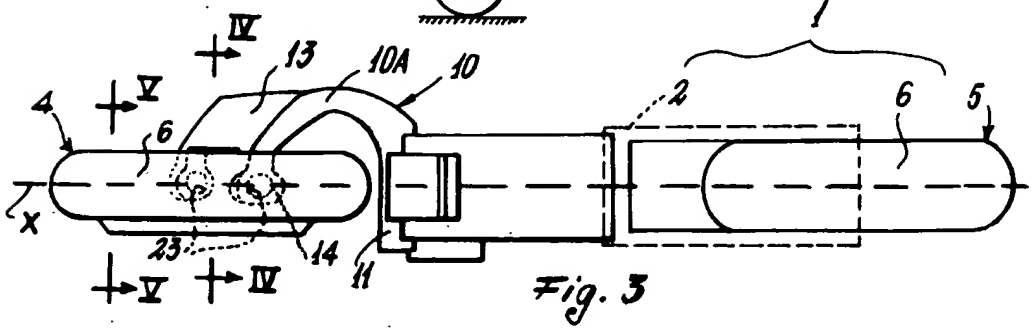

Fig. 3

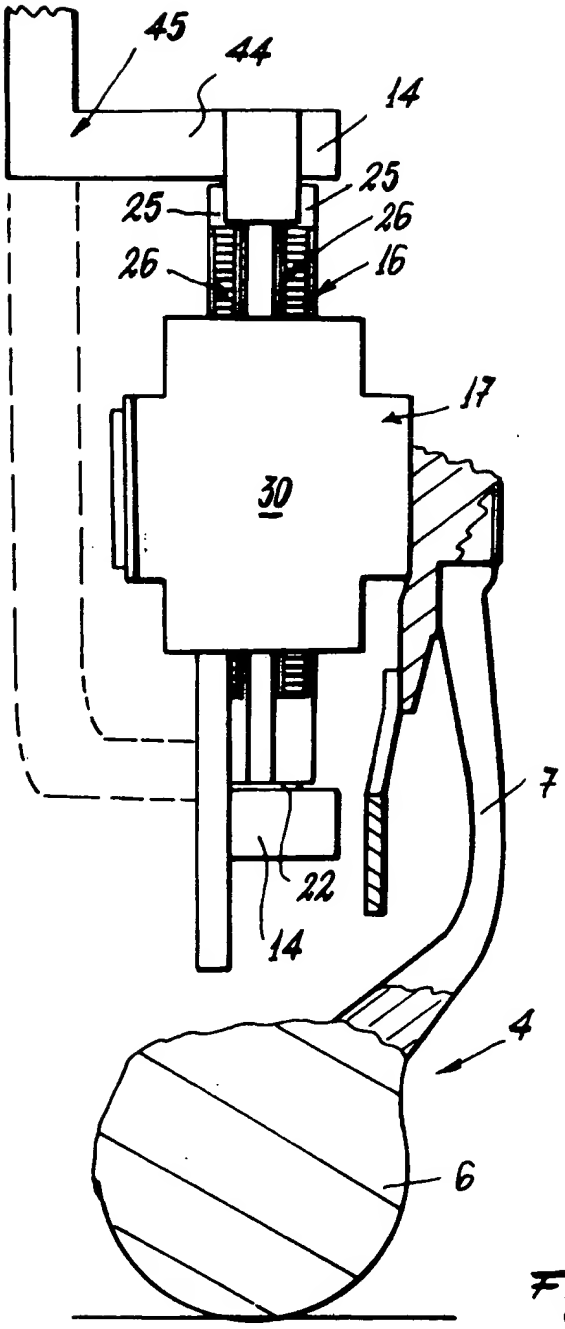

Fig. 5

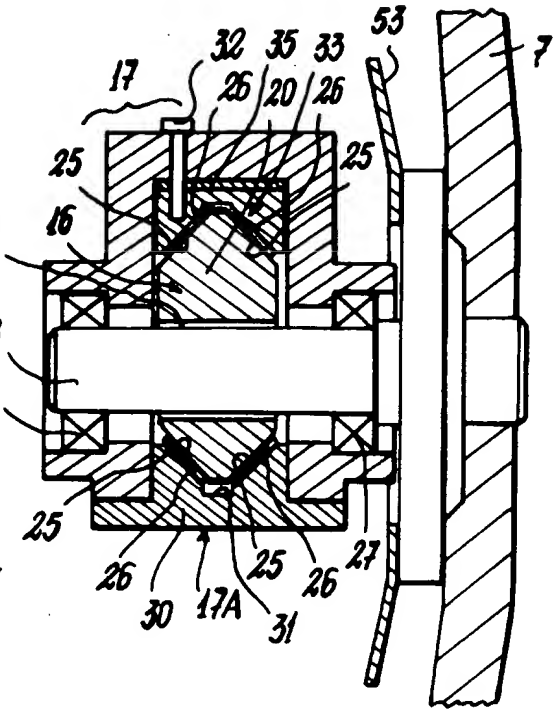

Fig. 4

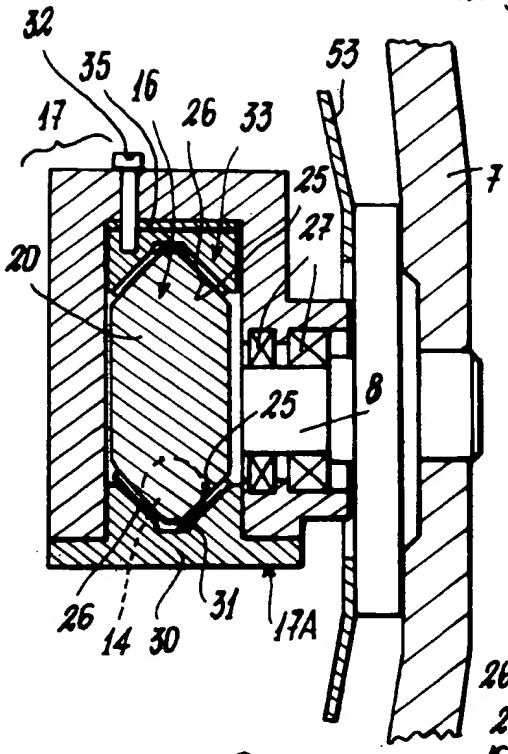

Fig. 6

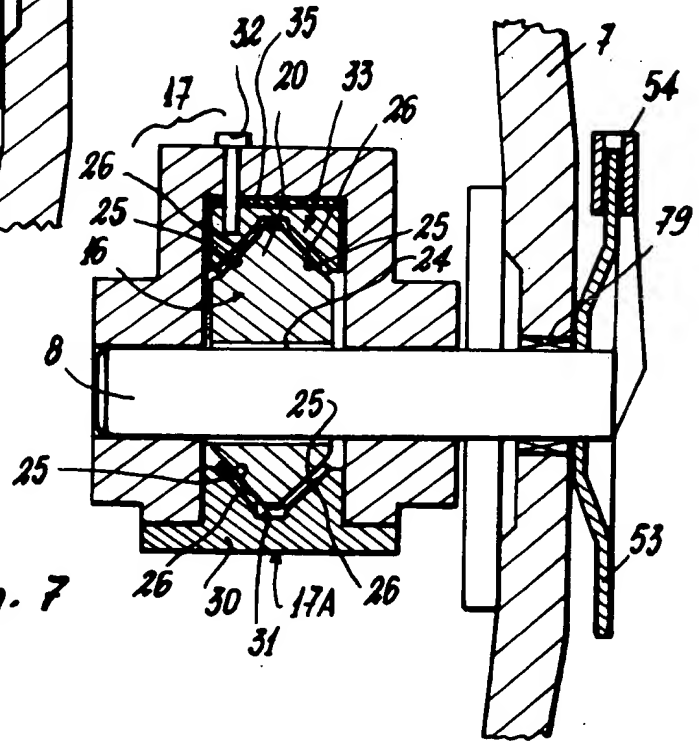

Fig. 7

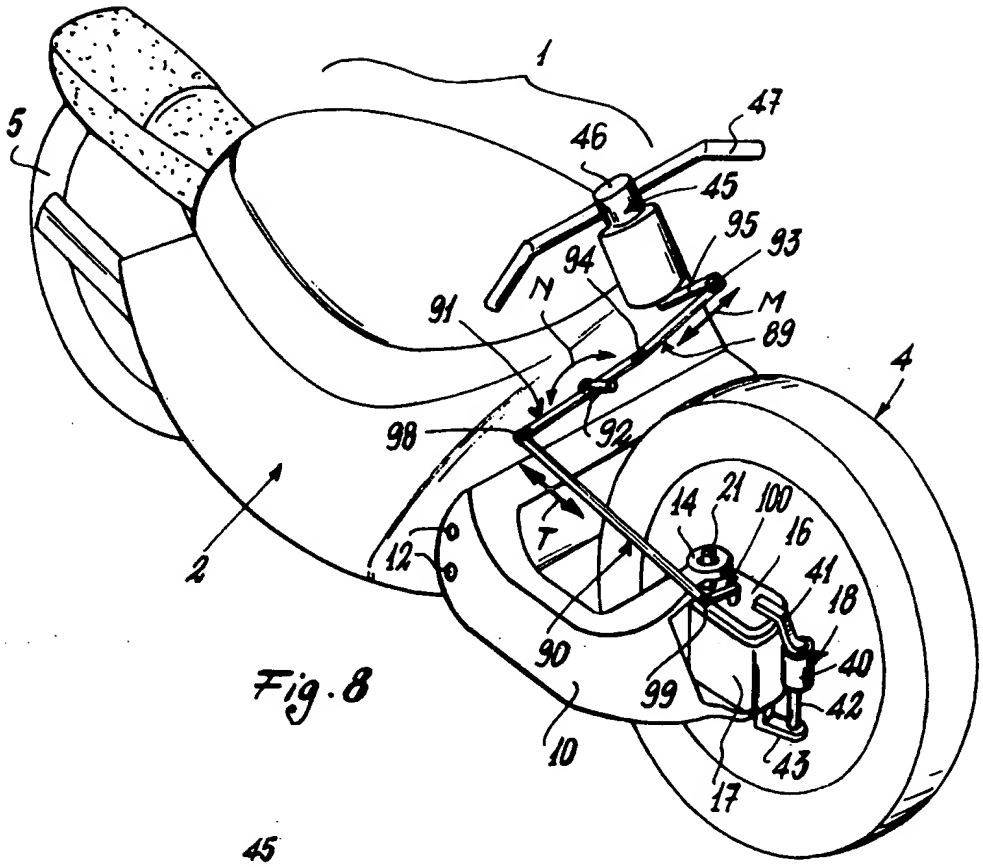
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Fig. 8

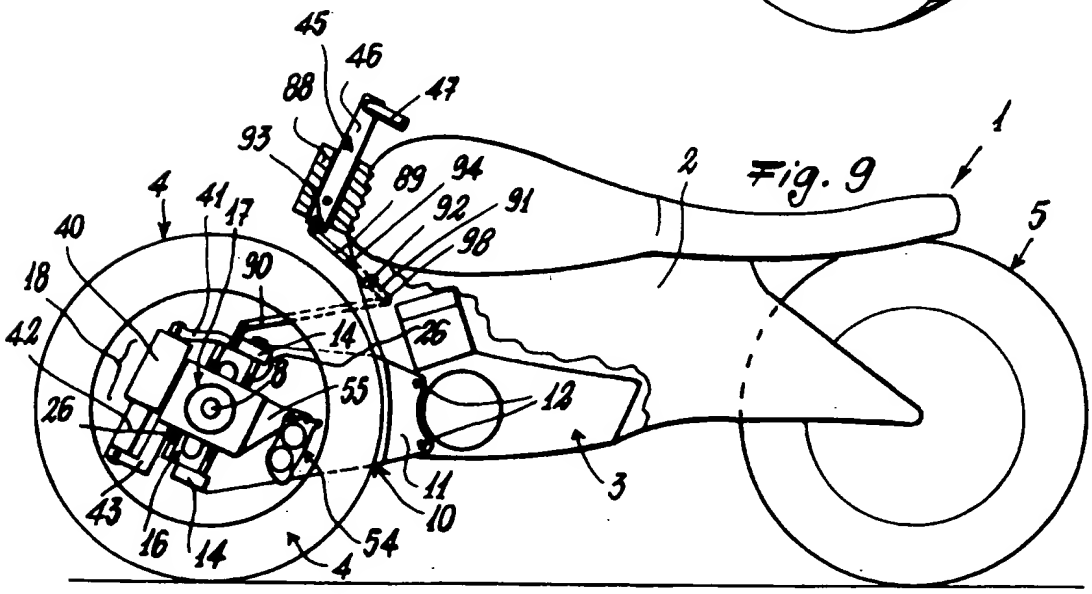
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Fig. 9

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 11 2559

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	EP-A-0 294 866 (WHITE POWER PROD.) * the whole document *	1-8, 12-14, 16,17	B62K25/00 B62K21/00
A		9,10	

A	FR-A-2 418 141 (DE CORTANZE) * page 3, line 36 - page 5, line 31; figures 2-4 *	4,12,18, 19	

A	EP-A-0 211 638 (HONDA) * page 3, column 3, line 5 - column 4, line 28; figures 3,4 *	12,18,19	

A	GB-A-833 741 (BOTHWELL) * page 2, line 38 - line 48; figure 1 *	7	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)
B62K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	04 NOVEMBER 1991	DENICOLAI G.

CATEGORY OF CITED DOCUMENTS

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